NATURAL RESOURCES CONSERVATION SERVICE

VIRGINIA INTERIM CONSERVATION PRACTICE STANDARD

SINKHOLE AND SINKHOLE AREA TREATMENT

(Acre)

CODE 370-Interim

DEFINITION

Treatment of sinkholes and/or sinkhole areas to reduce contamination of groundwater resources.

PURPOSE

This standard shall be applied as part of a resource management system to treat a source of groundwater pollution by reducing the amount of nutrients and/or sediment entering a sinkhole. The purpose for closing a sinkhole would be to improve farm safety or to stabilize the sinkhole.

SCOPE

This standard does not apply to sinkholes located within 100 feet of a structure or a water supply sued for human consumption.

CONDITIONS WHERE PRACTICE APPLIES

On any land surface or existing practice where geologic conditions resulted in the development of sinkholes and where contaminated surface water and other contaminated material have the opportunity to enter sinkholes and pollute the groundwater resource or where safety is a concern.

CRITERIA

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

The installation and operation of sinkhole treatment(s) shall comply with all federal, state, and local laws, rules, and regulations.

The location of a sinkhole shall be marked on the conservation plan.

Trash and other material shall be removed from the sinkhole and disposed of in an environmentally sound manner as directed in the Virginia Conservation Practice Standard *Obstruction Removal (Code 500)*.

The type of treatment selected is based upon the resource protection need and the outlet conditions, and may include vegetated filter strips, surface water control measures, and direct sinkhole treatment.

Current and planned land use shall be considered. In particular, houses, septic fields, wells, feedlots, ponds, and animal waste storage systems shall not be located over a sinkhole site or within the impact area.

VEGETATIVE TREATMENT

All sinkhole areas shall have a vegetated buffer. The buffer area may be extended to include concentrated flow channels entering the sinkhole. Vegetative treatment of sinkhole areas is addressed in Virginia Conservation Practice Standards *Riparian Forest Buffer (Code 391),*

Riparian Herbaceous Cover (Code 390), and *Filter Strip (Code 393)*. The width of the vegetated buffer shall be established and maintained in accordance with the type of buffer chosen.

The *Plant Establishment Guide for Virginia* shall be used to select the appropriate vegetation. The Virginia Conservation Practice Standard *Tree/Shrub Establishment (Code 612)* shall be used, as needed.

Livestock exclusion is required. The Virginia Conservation Practice Standards *Fence (Code 382)* or *Use Exclusion (Code 472)* shall be used.

Nutrient and pest management plans shall be developed in accordance with Virginia Conservation Practice Standards *Nutrient Management (Code 590)* and *Pest Management (Code 595)* for the drainage area of the sinkhole controlled by the landowner.

Nutrients, herbicides, pesticides, and animal waste shall not be applied within an established buffer. Only mechanical treatments may be used for weed control.

Appropriate erosion and sediment control measures shall be used to protect sinkhole openings during the establishment of the vegetative filter.

SURFACE WATER CONTROL

Changes to the volume of surface water that enters a sinkhole may disturb the underground hydrology. To the extent possible, the surface water flow should be maintained at historic (or predevelopment) volumes.

Pre-existing concentrated flow channels may be stabilized but should not otherwise be altered. If a plug or inverted filter is used, the area to be protected shall be delineated by a qualified geologist. Concentrated flow caused by the construction activities shall be dispersed with a suitable spreading structure.

SINKHOLE CLOSING

Adequate protection of most sinkhole and sinkhole areas can be achieved by the use of vegetative buffers and livestock exclusion. However, if an open sinkhole is a safety hazard, it may be closed with an inverted filter, as shown in Engineering Technical Note #8 – Sinkhole Closing.

For a sinkhole receiving contaminated overland flow, every effort should be made to first treat the source of the contamination. Although it is important to maintain the hydrology of the karst system, it may be more beneficial to the groundwater quality to divert the contaminated water away from the sinkhole. In some cases, it may be necessary to completely plug a sinkhole rather than close it with a filter. An example of this would be a sinkhole in a feedlot or a site that is difficult to protect any other way.

Sinkholes that open into caves may not be filled under any circumstances. Gated openings may be used for safety reasons. Coordination with the Virginia Cave Board or the Karst Program office is required.

All sinkhole closings require the approval of the State Conservation Engineer with concurrence from the Virginia Department of Conservation and Recreation, Division of Natural Heritage, Karst Program Office.

CONSIDERATIONS

This practice includes the systems approach for solving the problem by treating both the sinkhole directly, and its drainage area. When possible, the practice should work in conjunction with the beneficial effects of existing or planned conservation cropping systems, pest and nutrient management and practices that control sheet, rill and gully erosion.

The sinkhole treatment should not result in surface water ponding or high soil moisture conditions over an extended period of time. However, since percolation rates vary among different soils, ponding and soil moisture conditions may also vary.

Excess surface water caused by construction activities may be diverted from the sinkhole area in accordance with the Virginia Conservation Practice Standard *Diversion (Code 362).*

The sensitivity of the site to groundwater contamination should be assessed.

Engineering Technical Note #9 – Sinkhole Classification should be used to describe sinkholes and sinkhole areas.

Treatment of one sinkhole may have an effect on other sinkholes in the vicinity. Anticipated effects should be noted.

The use of a Conservation Easement for the buffer and sinkhole should be considered.

PLANS AND SPECIFICATIONS

Plans and specifications for Sinkhole Treatment shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

DESIGN DATA

1. Plan view showing sinkhole and sinkhole area. Include topographic information and photographs.
2. The geologic investigation shall include a study of potential impacts on the Karst resource.
3. Planned treatment measures.
4. Drainage area of sinkhole
5. Availability of safe outlet for surface water, if applicable
6. Completed Sinkhole Assessment Job Sheet.
7. Operation and Maintenance requirements.
8. Special safety requirements.
9. Environmental Assessment.

Data requirements for sites where the sinkhole will be filled are listed in Engineering Technical Note #8.

CHECK DATA

1. Seeding performed
2. Documentation of site location
3. As-built drawings and quantities.

OPERATION AND MAINTENANCE

The owner/operator shall be responsible for maintaining the treated sinkhole and sinkhole area according to the plan and design provided.

REFERENCES

1. *Estimating Runoff and Peak Discharges*, USDA-NRCS, Engineering Field Handbook, Chapter 2, August 1987.
2. *Urban Hydrology for Small Watersheds,* USDA-NRCS, Technical Release 55, June 1986.
3. *Graded Riprap Stone, Quarried Stone for Erosion and Sediment Control*, National Crushed Stone Association, June 1978.
4. Koerner, R. M., *Designing with Geosynthetics,* Prentice-Hall, Englewood Cliffs, NJ, 1985.
5. *Geology*, USDA-NRCS, National Engineering Handbook, Part 531, Section 8, Chapter 1, 1978.
6. NRCS, Virginia Field Office Technical Guide, Section IV.
7. *Living on Karst – A Reference Guide for Landowners in Limestone Regions*. Cave Conservancy of the Virginias, 1997.
8. Technical Notes 8 and 9.
9. DCR-MS19.

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Approved Practice Narratives

(Acre)

CODE 370-Interim

370-Interim D1 Sinkhole and Sinkhole Area Treatment: A sinkhole area will be treated with a vegetated buffer to reduce the potential for contaminated surface water to enter the groundwater. Livestock will be excluded from the buffer area.

370-Interim D2 Sinkhole and Sinkhole Area Treatment: A sinkhole with a drainage area of less than 5 acres shall be treated with an inverted filter to reduce the potential for contaminated surface water to enter the groundwater. A vegetated buffer will be established around the sinkhole.

370-Interim D3 Sinkhole and Sinkhole Area Treatment: A sinkhole with a drainage area of 5 to 15 acres and a safe outlet for surface water shall be treated with an inverted filter to reduce the potential for contaminated surface water to enter the groundwater. The planned surface water control measured will reduce the internal drainage area of the sinkhole to less than 5 acres. A vegetated buffer will be established around the sinkhole.

370-Interim D4 Sinkhole and Sinkhole Area Treatment: A sinkhole with a drainage area of 5 to 15 acres and no safe outlet for surface water will be treated with an inverted filter to reduce the potential for contaminated surface water to enter the groundwater. A vegetated filter will be established around the sinkhole and livestock will be excluded from both the sinkhole area and the filter.

370-Interim D5 Sinkhole and Sinkhole Area Treatment: A sinkhole with a drainage area greater than 15 will be treated with an inverted filter to reduce the potential for contaminated surface water to enter the groundwater. A vegetated filter will be established around the sinkhole and livestock will be excluded from both the sinkhole area and the filter.